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Reputation and Trust in Social Networks: Empirical results from a Facebook Reputation system

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ABSTRACT

Reputation systems play a key role in ensuring responsible online behavior in web properties and foster user participation. This paper examines the need for peer to peer social reputation system and shares the results from building a social reputation system for Facebook. The results indicate that for peer to peer social reputation systems it is a better practice to capture specific reputation scores at granular levels rather than high level reputation scores. We establish the importance of identity of entities in the success of peer to peer reputation systems. We also show that by combining both qualitative comments and quantitative scores, the reputation system gains in richness and diversity and helps capture much more information than the pre-defined questions.

Keywords

Reputation system, Human-computer interaction, Social Networks, Trust

INTRODUCTION

Social Networking destinations such as Facebook, Twitter, Google Plus etc. have witnessed exponential growth over the years. Social network users rely on profile and interaction signals, such as number of mutual friends, photos, wall posts, comments, likes, group membership etc. when evaluating each other. There is an element of risk while interacting with strangers in online social networks such as potential privacy violations, spread of malicious content, social-engineering attacks, online grooming, cyber-stalking, cyber-bullying etc. Questions of the type should I accept friendship request from a stranger? is the advice from a new friend reliable? are possibly answered in the physical world by understanding the reputation of entities in the form of reference letters, grapevine news, etc. This is not possible in the case of online social networks with hundreds of millions of participants spread across geographies. Therefore it is important to have reliable feedback mechanisms in online social networks in order to trigger growth as well as trust in interactions. Benefits from trusted social reputation system include increased peer to peer interactions which in turn result in positive information flows, encourage good behavior and healthy collaboration between geographically dispersed peers (Dellarocas, Fan, and Wood, 2004; Dellarocas, 2003; Resnick, Zeckhauser, Friedman, and Kuwabara, 2000). For example eBay's feedback mechanism is the primary means through which eBay elicits honest behavior and, thus, facilitates transactions between strangers over the Internet (Resnick and Zeckhauser, 2002).

Existing research on online reputation systems focuses on the exchange of goods and services (Resnick and Zeckhauser, 2002; Wood, Fan and Tan, 2003) as the basis for the reputation systems and scores. Study of reputation systems in transactional platforms such as eBay proves that buyers submit ratings to more than 50% of transactions (Resnick and Zeckhauser, 2002; Wood, Fan and Tan, 2003). There is a research gap in terms of the role of peer to peer reputation systems in non-transactional destinations such as social networks which are friends and family networks, communities of interest, communities of practice etc. The reputation system needs to facilitate a trusted network which in turn would have a role in the quality and quantity of network interactions. Research (Wasko and Faraj, 2005) shows that gaining reputation is one potential way an individual can benefit from active participation in an online community, leading to higher participations and knowledge contributions. This paper attempts to examine the role of social peer to peer reputation systems in social networks.

In this research we build a Facebook reputation system which can capture peer to peer reputation scores. As part of this research, we aim to answer the following research question:

How can we build a reputation system in non-transactional peer to peer social networks?

We also discuss the experience of users in adopting and using our Facebook reputation system and the usefulness of it. We conducted netnography studies to understand user behavior, user perception and enhanced participation facilitated by the system. Netnography is ethnography adapted to the study of online communities (Kozinets, 2002). Netnography studies have examined online communication between consumers (Kozinets, 1998; Kozinets, 2002) for understanding their attitudes, perceptions, imagery, and feelings.

The fake user base of Facebook has risen to 27% of the total users (Nyberg, 2010). If a Facebook user gets 10 friendship requests a day, only 7 or 8 are real and the rest are fake (Nyberg, 2010). People create fake accounts in social networking sites for various reasons, some of which are harmless whereas some have the purpose of inflicting physical as well as psychological harm to other users. This could result in dangerous situations wherein people with criminal intentions could be fake profiles and befriend unsuspecting users. These underline the fact that users of social networks, discussion forums, chat rooms etc. should be wary of the fact that people online may not be who they seem.

Reputation score of a user is a key information source that can be used to decide which users one can interact with and who to avoid. Our objective is to build a scalable, reliable as well as user friendly reputation system which can encourage users to interact with peers over social networking destinations with confidence and trust and without the fear of associations with criminal minded users. This paper contributes towards this direction by building, implementing as well as user testing a peer to peer reputation system for Facebook which combines quantitative as well as qualitative measures. The rest of this paper is organized as follows: section 2 covers the literature review of reputation systems, section 3 examines the methodology of building the Facebook reputation system, section 4 discusses the results of the study. Finally, we conclude and discuss implications for decision makers, online social networks and identify directions for future research.

SURVEY OF REPUTATION SYSTEMS

Reputation systems existed long before emergence of Internet, with word-of-mouth being one of the earliest instances of offline reputation systems. Internet has facilitated large-scale word-of-mouth networks in which individuals share opinions, experiences and knowledge on a wide range of topics via reputation systems (Dellarocas, 2003). In recent years, reputation systems have been widely adopted as an important characteristic of many online communities, helping to elicit good behavior and encourage knowledge sharing among loosely connected and geographically dispersed individuals. The primary objective of a reputation system is to collect, aggregate and share reputation related feedback to other members as well as groups. Reputation systems play an important role in the presence of imperfect information about the online network participants, by helping the network participants to manage risks. In the process, they bring together known and unknown users based on their reputation scores thereby helping them to make a decision on whom to trust and connect with, foster good behavior and discourage untrustworthy entities. Prominent examples of implementations of reputation system include Slashdot, ePinions, Amazon, eBay, Yahoo! Answers, Yahoo! Widgets, Digg, Wikipedia, World of Warcraft, Reddit, Digg, PersonRatings.com, Yelp etc.

There are multiple definitions for reputation and no one definition has received widespread acceptance. According to social network researchers (Freeman, 1979; Marsden, and Lin, 1982) reputation is what is generally said or believed about a person's or thing's character or standing. Reputation is defined as 'the collected and processed information about an individual's past behavior as experienced by others' (Schlosser, Voss, and Brückner, 2006). Authors (Josang, Ismail, and Boyd, 2007) have defined reputation as a collective measure of trustworthiness or reliability based on the referrals or ratings from members in a community. Reputation is also defined as the 'characteristic or attribute ascribed to one person by another' (Wilson, 1985). According to some authors (Resnick, Zeckhauser, Friedman and Kuwabara, 2000), reputation systems must provide information that allows buyers to distinguish between trustworthy and non-trustworthy sellers, encourage sellers to be trustworthy, and discourage participation from those who aren't.

Reputation systems which aggregate the values

These are reputation systems that aggregate the reputation scores based on the summation of all given ratings. For example, eBay has a reputation system called the Feedback Forum, which captures buyer and seller feedbacks on a three point scale (1, 0, or -1) as well as capture qualitative comments such as "Good product", "Great seller", "Will buy again from the same seller" etc. The reputation scores are given by both the buyer and seller after completion of the transaction. The objective behind this system is to inform buyers and sellers about the feedback of their experience and in turn convey whether their

potential trading partners are trustworthy or not. The eBay feedback forum enables buyers and sellers to build their reputation based on the reputation scores as well as the comments given by their transaction partners. This data and information is visible on the profile pages of the members and helps to establish the trustworthiness of the partners.

Reputation systems which average the values

Average reputation systems compute the average of all reputation scores received by the entity. Previous research (Yu and Singh, 2002) has examined this issue with a reputation system that takes into account an entity's reputation as an average value of all the ratings received by the entity. RateMDs.com follows such a reputation system. RateMDs is a physician rating site, and uses smiley faces (😊 😐 😞) for average ratings of >3 , $=3$ and <3 to tell us about how good the doctor is. Advantage of such a reputation system is that honest and trustworthy entities can reap the benefits of good reputation earned across transactions. The disadvantage of this reputation system is that there is a possibility of dishonest agents allocating wrong ratings and thereby impacting the overall average reputation score.

Reputation systems which blur the values over time

This type of reputation systems has a time-dependent weight function, where older reputation ratings have lesser weightage as compared to the recent scores. The key assumption is that entities behave more like they did in their most recent transactions than they did in the long ago past. Researchers (Huynh, Jennings and Shadbolt, 2006) have designed a blurred system by combining reputation, context based rules, and credentials in an agent system. Another example is the OnlyLast system (Dellarocas, 2003) which assumes that an entity behaves like it did the last time, no matter what it did before and hence only the most recent rating given to the entity is considered.

METHODOLOGY OF BUILDING THE FACEBOOK REPUTATION SYSTEM

Features of the application

The authors designed and built the Facebook reputation system by drawing upon some of the existing successful peer-to-peer reputation systems. However no one system meets the requirement of a combination of quantitative and qualitative measures. Our reputation system resides on Facebook and entities are users themselves. A reputation score in this application's context is used to judge reliability and trustworthiness of a person instead of an item. A reputation rating is calculated using feedback from the user's peers on Facebook. This score is a numerical representation of how well the user is ranked based on past experiences with and impressions on his/her friends. The application aims to gather feedback from multiple reliable peers and use that information to calculate a score.

In order to make it easy for users to submit feedback this application allows them to rate the person based on different attributes of personality. The score that is calculated is actually a weighted average of the ratings submitted by all peers. It also has an option for users to submit a comment that best describes their friend's positive or negative attributes of personality. The personality attributes used to judge each person are divided into 2 groups i.e. 'Personal' and 'Professional'. The personal section includes 'Predictability', 'Caring', 'Trustworthiness', 'Selflessness', 'Sincerity' and the professional section includes 'Leadership', 'Organization', 'Punctuality', 'Confidence', 'Competency'. These attributes were chosen, as they are the most basic, common and yet important factors when judging a person's behavior in both personal and professional sides of life. Ratings that are given to users would be useless if they are not easily visible to others. Facebook allows users to add a tab onto their profiles, which can render a particular page from the application. In this way, a user's rating can be shown on a tab on his/her profile so as to make it easily visible to his friends and new users that are interacting with him.

The algorithm

Having a total of 10 attributes to rate, each attribute can be rated on a Likert scale of 1-5 where 1 refers to 'Very Low', and 5 refer to 'Very High'. Each of these scores are added up to a maximum total of 50 and doubled to scale it to 100. Every user's submitted score is stored and added to the total with a weight and the weighted average of the total is calculated for a particular person using the formula below. Therefore a user's reputation score is a weighted average of his past ratings. Weights assigned are a function of the number of peers who have given a reputation score. \bar{X} is the Weighted Mean Reputation score, W_i is the weight function and X_i is the individual reputation score as given by peers.

$$\bar{x} = \frac{\sum_{t=1}^n w_t x_t}{\sum_{t=1}^n w_t}$$

Every time a new score is added after the average has already been calculated, the average is multiplied by the initial total weight, added to the new weighted score and divided by the new total weight to get the new average rating. For every user, all of his friends can submit a feedback but each can only do it once and changes cannot be made. Additionally a user is not allowed to submit feedback for him/her. Moreover, each submitted rating is anonymous i.e. no one but the submitter knows who and how much he/she rated.

Weights between 0.0-1.0 are used to differentiate ratings provided by different kinds of users. This allows the application to give some ratings more 'importance' than others. Ratings provided by users with fewer than 10 friends on Facebook are given a weight of 0 thus their submissions do not affect the overall rating at all. Moreover each friend rating is weighted based on his/her own reputation score. In addition to the feedback questions and answers, a 'Comment' text box stores the comment provided and strips it to tags. Common words used like 'he', 'is', 'that', 'the' are stripped off and the rest are stored in a tag database for each user. If a particular tag is already in the database for that user, its frequency increases by 1. Then, the most frequent tags are shown alongside each user's rating on the application. Each tag has a relative size, with the more frequent having a larger size than the lesser frequent ones.

Walkthrough of the application

Figure 1 is a screenshot of the Reputation System as visible on the Facebook Profile page. Totally about 109 users incorporated the application into their profiles. Of these, about 25 were monthly active users. The average reputation score in the system is 82.



Figure 1. Reputation System as visible on the Facebook Home page

On the index page of the application (Figure 2), a search bar is shown to search for any friend to submit feedback for or just to view reputation rating of. In addition to that, a random list of five friends is shown. At most 3 out of those 5 are friends that already have a reputation rating in the system and the others don't.



Figure 2: Index page of the Facebook Reputation System

Clicking on any name or searching for someone will take you to the “reputation profile page” as shown in Figure 3. This profile page displays the person’s name and his/her picture. In the right hand side of the box, it shows 2 rows of scores, the overall reputation rating of the person and the score submitted by the viewer.



Figure 3: Reputation profile

Below the scores, a tag cloud is displayed which shows the top 20 most frequent words submitted by the person’s friends through comments. As we can see, the button in the middle of the screen says “Click to Rate other friends”. That’s because the viewer has already submitted a rating of “80” for the person. If a rating had not been submitted yet, the button would say, “Click to submit a score” as shown in Figure 5. When the mouse cursor is dragged over a tag, it shows how many friends submitted that word as comment as shown in Figure 4 below.



Figure 4: Reputation profile

Moreover, the “reputation profile page” displays the number of ratings submitted for that particular person at the bottom right hand corner. When one wants to submit a score, by clicking on “Click to submit a score”, the application takes you to the feedback page as shown in Figure 5. In this page the user can rank the person by selecting relevant fields of each attribute of personality, add a comment in the text box and submit that into the system. This score would be added to the total and the reputation rating would be updated accordingly.

Figure 5: Reputation Feedback

Once the user submits his feedback, a prompt comes up which asks whether Facebook should publish this to his/her profile’s wall as shown in Figure 6. This news would only state that the user has used this application for submitting a rating and a link is provided for others to do so. No information about who this user has submitted feedback for is displayed. Once someone adds this application, he/she can add an application tab on his profile that would show his “reputation profile page” to everyone who visits his/her profile.

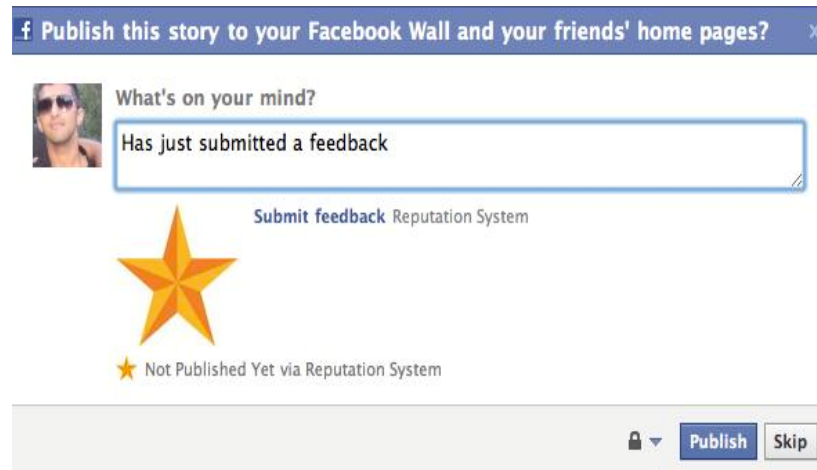


Figure 6: Publish the Reputation score to the user's profile

RESULTS OF THE STUDY

The numerical score

The best way to translate feedback from people is to actually convert it into a numerical value which can be manipulated by adding weights and computing the average. This score, optionally attached to a person's profile, is not intended to be used as a scale for comparison between different people. It is merely a tool to be used to help in judging whether the person is trustworthy for communication, collaboration and transactions without prior experience. The main purpose of this score is to help explicitly display the extreme negativity or positivity of a person's character.

Addressing common problems

One of the most common problems is that of Sybil attacks. In the Internet, identity of users is a key problem and multiple new identities may be created by one entity with ease and these are called sybils. Users may create enough sybils to constitute a large percentage of the community and use them to boost their own ratings. In our Facebook reputation System, to reduce the effects of such a problem occurring, when a user submits a ratings for someone else, the weight given to his/her rating is 0 if he/she has fewer than 10 friends. This doesn't totally remove the problem of sybils, it actually makes it harder for someone to use sybils to boost his/her rating as each of those sybils would need to make 10 friends before the submitted rating would have an effect in the overall rating of the user. Moreover, each user can only submit a rating for a particular peer once. This would not allow a user to find a friend to submit multiple positive ratings to boost his overall reputation score.

Furthermore, in many systems, someone with a very negative rating, can easily close his/her account and open a new one with a different identity which starts with a fresh one. In this way, he will be able to indirectly remove all of his past submitted feedback. This happens frequently in eBay where sellers with highly negative ratings would just create new differently named accounts to sell their items with a fresh rating instead of a negative one. This problem's effects, though hard to totally remove, are minimised in our system. This is due to the fact that on Facebook people are identified by their names and photos. If one joins Facebook with a different identity, he/she wouldn't be using Facebook in a way that's recommended and will be a violation of Facebook's terms and conditions which also forbids users from registering for more than one account or use or attempt to use another's account, service or system without authorization or create a false identity on the Service or the Site.

One fundamental issue faced by all reputation systems is the incentive to actually submit a feedback. One might not benefit in any way by submitting a rating for someone or some item. This issue does exist in this application, however, as usage of this application increases and network effects kick in, users will have the incentive that if they submit ratings for their friends, their ends would submit ratings for them too. Another incentive would be that this reputation application is the way to actually provide personal opinion of your friends and make it public to Facebook users.

Benefits

The most obvious benefit of the research is that it makes it easier to trust new people online by having access to a reputation score based on feedback from peers and friends. When a user on Facebook tries to interact with someone new, maybe for collaboration or dating, he/she would be able to view the reputation rating of the person he/she is interested in. This score, if highly negative, would allow the user to make an informed decision regarding social network interactions. This system is also beneficial when carrying out transactions over the internet as a person with a highly positive reputation rating would be less likely to cheat or fraud.

There also exists an indirect benefit which can be classified as improved behavior of people. For example, when an employer sets out looking for a new employee, he may ring up the references provided on the resume to get some feedback and to test whether the past experiences provided were genuine. Focusing on the references it is obvious everyone would list down the references, which would only have an idea of the positive aspects of personal and professional aspects. This reputation system allows all peers to come together and submit their views.

Furthermore, we have a key element of Qualitative measures for reputation. This effectively enhances and strengthens the quantitative scores it as key personality and professional aspects of end users can be effectively expressed. This gives users the opportunity to express their views in any personalized way they like which captures much more than the defined questions.

Netnography based user feedback

We adopted netnography to help us get some quick feedback from the end users of the reputation system. We were keen to understand the voice of the end users of the system as the usefulness and effectiveness of the system is best measured through end user feedback. Listed below are the comments received from some of the users of our Facebook reputation system:

User 1: "This application looks simple and nice. Instead of being a useless application it is based on a serious issue of reputation scores which help when meeting new people online"

User 2: "Application has a simple design which is user-friendly. The program is useful as it allows friends to give constructive comments about each other. The application is also useful in giving a point-based result for each person, which can be used for comparison and further improvement of inter-personal skills. This application would be highly useful when used as a component of a psychometric test."

User 3: "The user interface started off with giving some sample friends (i.e. certain friends in your own friends list). It's interesting to rate your friends based on it. Also, there's a comment box which allows the user to give extra information or comments regarding a specific person."

User 4: "Overall, the application is quite fun to be used among friends and also help them improve themselves."

Drawbacks and future improvements

One of the features missing from this application is the incentive for participation and assigning scores and qualitative feedback for peers. Currently, there are limited incentives for a user to actually submit a feedback for friends. The only small way that it is actually encouraged is the optional automatically generated wall post that a user can post to his/her profile after every submitted rating which would make it easier for people to find the application and also make it more popular among friends.

Additionally, since ratings for a particular person can only be submitted once by every user and these ratings remain permanent in the application, it doesn't capture the improvement and deterioration in behavior. If a person, after receiving bad feedback, realises his drawbacks and tries to improve them over time, this application would not be able to accurately capture the new feedback from peers as the past feedback would remain permanent. This problem could be addressed by actually making older reputation rating submissions less important as time goes by. This type of reputation systems has a time-dependent weight function, where older reputation ratings have lesser weightage as compared to the recent scores. The assumption here is that recent behavior is probably a better predictor of future behavior than past behavior. A reduced weightage could be used for old feedback submissions and users could be allowed to submit another rating after every six months to a year. Currently, every question on the feedback is given equal importance. Sometimes, a few questions would be more important than others to capture qualities for example the aspect of being punctual may be more important than being caring in the professional sense. This could be improved in the future by adding weights to questions themselves to differentiate the relative importance.

CONCLUSIONS

We built a peer to peer social reputation system for Facebook and observed the behavior of users and their adoption of the system. We present an effective way of peer to peer reputation system for social networks which combines quantitative and qualitative measures. The system has the option of submitting peer to peer numeric scores based on a set of questions on a standardized scale to judge personal and professional reputation. A combination of both qualitative comments and quantitative score gives this application diversity. Instead of just following the given format and the set of questions, the comment box gives users the opportunity to express their views in any personalised way which captures much more than the defined questions.

The system is easy to use system as it is best to have as few questions as possible to capture a set of key personal and professional reputation factors. The problem of lack of incentive makes users reluctant to submit a feedback and having a large set of questions and many different answer possibilities would make it very complex and reduce the usability aspect of the application. Finally, identity of users is a critical issue in ingraining a degree of seriousness and importance into the process of peer to peer social reputation systems. If the identity of user cannot be established by his/her peers, the motivation for assigning a reputation score is limited and therefore the accuracy and robustness of the reputation system would be impacted. Social networking sites include interactions, collaborations, transactions and information exchange with unknown people who are hard to trust without prior experiences. Even though trust is hard to achieve online, this Facebook application would reduce the number of frauds, false identity scams and encourage a positive behavior in the virtual world thereby making it a safer place for all of us.

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